IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

PURDUE PHARMA PRODUCTS L.P., NAPP PHARMACEUTICAL GROUP LTD., BIOVAIL LABORATORIES INTERNATIONAL, SRL, and ORTHO-MCNEIL, INC., Plaintiffs/Counterclaim-defendants, v. PAR PHARMACEUTICAL, INC. and PAR PHARMACEUTICAL COMPANIES, INC., Defendants/Counterclaim-plaintiffs.	C.A. No. 07-255-JJF (CONSOLIDATED)

DECLARATION OF DR. MARTYN C. DAVIES IN SUPPORT OF PLAINTIFFS' OPENING BRIEF ON CLAIM CONSTRUCTION

I, Martyn C. Davies declare pursuant to 28 U.S.C. § 1746 that:

1. I reside in Nottingham, England. I am qualified in all respects to make this declaration and have personal knowledge of the facts set forth herein, except as specifically stated otherwise.

2. I have been retained by Purdue Pharma Products L.P., Napp Pharmaceutical Group Ltd., Biovail Laboratories International, SRL, and Ortho-McNeil, Inc. (collectively "Plaintiffs") as an expert consultant in the above-referenced litigation.

3. I understand that Plaintiffs have accused Par Pharmaceutical, Inc. and Par Pharmaceutical Companies, Inc. (collectively "Par") of infringing certain claims in U.S. Patent

No. 6,254,887 ("'887 patent") and U.S. Patent No. 7,074,430 ("'430 patent") (collectively "the patents in suit").

4. I have reviewed the claims, specification and file histories of the patents in suit. I understand these patents have a common disclosure. For ease of reference, all citations to the specification are to the '887 patent, unless stated otherwise.

5. I am a person skilled in the art of pharmaceutical sciences. A copy of my *curriculum vitae* is attached as Exhibit 1.

6. I graduated with a first class honours degree in Pharmacy from the University of Brighton in the United Kingdom. I received my Ph.D. in physical chemistry and surface energetics of hydroxypropylmethylcellulose film coatings from the Chelsea School of Pharmacy, Kings College University of London in 1985. I am currently Professor of Biomedical Surface Chemistry at the University of Nottingham in the United Kingdom, where I have been teaching for the last 23 years. I served as Deputy Head of the School of Pharmaceutical Sciences from 1999 until 2000 and was Head of the School of Pharmaceutical Sciences and the Pharmacy School from 2000 until 2003. I served as Vice Dean for Health Sciences at Nottingham University Graduate School from 1995 until 1997.

7. In addition to my professorship, I was Co-Founder and Director of the Laboratory of Biophysics and Surface Analysis. My present research interests include drug delivery, embracing controlled release technology. Over the past 20 years, I have supervised more than 100 graduate students and post-doctoral associates in Biomedical Surface Chemistry and Pharmaceutical Sciences. I have taught both undergraduate and graduate courses in physical chemistry, pharmaceutical technology, drug delivery and biomedical surface chemistry for over 20 years. I have authored and co-authored more than 320 articles in the fields of Biomedical

Surface Chemistry and Pharmaceutical Sciences. I regularly act as a referee for a variety of academic journals, including the fields of drug delivery and pharmaceutical technology. I am currently on the editorial boards of Advanced Drug Delivery Reviews, the European Journal of Pharmaceutical Sciences, the Journal of Pharmaceutical Sciences and the Journal of Controlled Release.

8. In 2003, I was named Fellow of the Royal Society of Chemistry, Fellow of the American Institute for Medical and Biological Engineering, and Fellow of the Royal Pharmaceutical Society of Great Britain. In 2003, I was also the recipient of the GlaxoSmithKline International Achievement Award presented at the British Pharmaceutical Conference on behalf of my research group and Molecular Profiles, the first time it was awarded to a group. I have received national and international recognition for my contributions to the development and characterisation of pharmaceuticals, biomaterials and drug delivery systems, including being the recipient of the Pharmatec Prize in 1988, a 1991 Pfizer Academic Award and recipient of the Controlled Release Society's Young Investigator Award in 1997. I was named Science Chairman of the Millennium Meeting of the British Pharmaceutical Conference in 2000.

9. I am an invited member of a number of Learned Societies, including the Royal Pharmaceutical Society of Great Britain, the Royal Society of Chemistry, the American Chemical Society, the American Association of Pharmaceutical Scientists, and the United Kingdom Academy of Pharmaceutical Scientists. I served as a member of the Board of Governors of the Controlled Release Society from 1997 until 2000. I am the Founder of the United Kingdom Controlled Release Society and served as Acting Chairman of the Steering Committee from 1994 until 1997. I was re-elected the Scientific Secretary of the Controlled

Release Society (2002-2007) and have been a member of the Board of the Controlled Release Society since 2000.

10. I have founded or co-founded several academic and industrial programs and companies. I am the Co-Founder, Director and Chairman of Molecular Profiles, which provides consulting expertise to the pharmaceutical and healthcare industries. Molecular Profiles was presented with the Queens Award for Enterprise in the category of Innovation, the highest United Kingdom Industry Award. I am also Co-Founder of Regentec Ltd., a company which is a pioneer in the area of regenerative medicine and tissue engineering. I am currently a Director at Critical Pharmaceuticals Ltd. (a drug delivery company).

PERSON OF ORDINARY SKILL IN THE ART

11. I have developed an opinion as to the art pertinent to the subject matter of the patents in suit: the art of one or more of the fields of medicine, chemical engineering, chemistry, pharmaceutical sciences, pharmaceutics, pharmaceutical technology, pharmacokinetics and/or pharmacology.

12. The original application that led to the patents in suit was filed on May 10, 1994. That application claims priority to a German application that was filed on May 10, 1993.

13. I have personal knowledge that assists in understanding the level of skill in the art to which the patents in suit pertain in or around May 1993. In 1993, I had completed a Lectureship in Drug Delivery in the Department of Pharmaceutical Sciences and was actively employed in a Readership in Biomedical Surface Chemistry at the University of Nottingham. Further, by 1993, I had nine years of post-doctoral experience in academia and in drug delivery in pharmaceutics.

14. In my opinion, a person of ordinary skill in the art of the patents in suit as of May 1993 was typically a person with a degree in one or more of the fields of medicine, chemical engineering, chemistry, pharmaceutical sciences, pharmaceutics, pharmaceutical technology, pharmacokinetics and/or pharmacology and/or industry experience.

15. I base my opinion on my review of the patents in suit, and on my direct knowledge of the level of skill of scientists in the field in 1993.

16. In May 1993, I was a person of at least ordinary skill in the art to which the patents in suit pertain.

BACKGROUND OF THE TECHNOLOGY

17. The patents in suit are directed to controlled release Tramadol formulations. In other words, the patents are directed to controlled release formulations for the active pharmaceutical ingredient commonly known as Tramadol. (col. 1, lines 5-7).

18. As explained in the patent specification, Tramadol is "an orally active opioid analgesic." (col. 1, lines 10-12). Simply put, Tramadol is a pain killer. Certain salt forms of Tramadol, especially tramadol hydrochloride, are preferred for oral pharmaceutical preparations. (col. 1, lines 29-33).

19. Tramadol was known in various immediate release formulations before the inventions of the patents in suit. (col. 1, lines12-18). The purpose of an immediate release formulation is to release the entire dose of the active pharmaceutical ingredient to the patient's bloodstream as quickly as feasible. For orally administered dosage forms, this usually means the formulation disintegrates in the patient's stomach quickly.

20. Controlled release formulations are those dosage forms that achieve the release of the active ingredient in a controlled manner. One of ordinary skill in the art would

understand that there are various ways in which one could control the release of the active ingredient. For example, one could control the rate of release of the active ingredient over a period of time. By way of another example, one could control the release of the active ingredient such that it is only released by the alkaline pH found in the small intestine rather than the acid environment of the stomach by using coatings which dissolve at alkaline pH values.

21. In designing or selecting a controlled release technology for orally administered dosage forms, a number of factors must be taken into account. Among the factors that may be considered are the selection of the excipients used to create a controlled release formulation for the required application and the time scale of delivery; the environment (*e.g.*, pH, enzymes) of the gastrointestinal tract that changes as one moves from the stomach down through the intestines; the physicochemistry of the drug, *e.g.*, its solubility, and also its release profile from the dosage form (*in vitro* dissolution); how the body's physiology impacts on the *in vivo* levels of the drug released from the formulation by the absorption, distribution, metabolism, and excretion of the drug (pharmacokinetics); and how the drug impacts on the physiology and pharmacology of the body (pharmacodynamics).

22. Drug release can be studied in the laboratory using an *in vitro* dissolution test, that is performed using standardized test apparatus described in the United States Pharmacopeia and the European Pharmacopeia. In 1993, there were two methods employed for oral delivery systems, the paddle and the basket methods.

23. *In vitro* dissolution is used by formulators in an iterative process during drug development to identify formulations that are suitable candidates for testing in humans. Formulators repeat this process until a test formulation is created with a desired release profile.

In addition to its application during drug formulation development, *in vitro* dissolution is used for quality control of the drug product during manufacture.

24. In the context of the patents in suit, the *in vitro* release rate of a drug refers to the percentage of drug release over a particular time period as measured using an *in vitro* dissolution test. The patent specification describes preferred *in vitro* release rates corresponding to twice a day dosing and once a day dosing. (*See*, col. 1, line 40 – col. 2, line 61).

25. One of ordinary skill in the art would understand that there are various formulation approaches that may be used to develop a controlled release formulation. The patent specification of the '887 and '430 patents describes exemplary formulation approaches to developing controlled release Tramadol formulations.

THE DISPUTED TERMS OF THE PATENTS IN SUIT

26. I have been informed that a number of the disputed terms of the patents in suit appear in multiple claims and in both of the patents in suit. Their claim construction is therefore addressed using illustrative claim 1 of each of the patents in suit.

27. The following disputed terms appear in claim 1 of the '887 patent: "therapeutic effect," "a pharmaceutically effective amount of tramadol or a salt thereof," and "therapeutic effect for about 24 hours after oral administration." Claim 1 reads (with the disputed terms highlighted):

> 1. A controlled release oral pharmaceutical preparation suitable for dosing every 24 hours comprising
>
> a substrate comprising **a pharmaceutically effective amount of tramadol or a salt thereof**;
>
> said substrate coated with a controlled release coating;
>
> said preparation having a dissolution rate in vitro when measured using the Ph. Eur. Paddle Method at 100 rpm in 900 ml 0,1 N

hydrochloric acid at 37° C. and using UV detection at 270 nm, between 0 and 50% tramadol released after 1 hour; between 0 and 75% tramadol released after 2 hours; between 3 and 95% tramadol released after 4 hours; between 10 and 100% tramadol released after 8 hours; between 20 and 100% tramadol released after 12 hours; between 30 and 100% tramadol released after 16 hours; between 50 and 100% tramadol released after 24 hours; and greater than 80% tramadol released after 36 hours, by weight, said preparation providing a **therapeutic effect for about 24 hours after oral administration**.

28. The disputed terms "matrix," "normal release matrix," "therapeutic effect," and "therapeutic effect for at least about 24 hours" appear in claim 1 of the '430 patent. Claim 1 reads (with the disputed terms highlighted) :

1. A solid controlled release oral dosage form, comprising,

a therapeutically effective amount of tramadol or a pharmaceutically acceptable salt thereof incorporated into a **normal release matrix**,

said matrix overcoated with a controlled release coating comprising a polymethacrylate or a water insoluble cellulose,

said dosage form providing a **therapeutic effect for at least about 24 hours**.

CLAIM CONSTRUCTION OF THE DISPUTED TERMS

Therapeutic effect

29. One of ordinary skill in the art would recognize that the term "therapeutic effect" in the patents in suit has its ordinary meaning. Plaintiffs' proposal that "therapeutic effect" means "effective for the treatment of one or more clinical conditions, *e.g.*, pain" is consistent with my understanding as a person of ordinary skill in the art.

30. One of ordinary skill in the art in reading the specification of the patents in suit would understand that the patents are directed to controlled release Tramadol formulations. The active pharmaceutical ingredient, Tramadol, is an analgesic and is used to treat pain in humans. (col. 1, lines 10-25).

31. One of ordinary skill in the art would understand that therapeutic effect can be demonstrated in different ways. For example, the specification of the patents in suit describes a parameter associated with human blood plasma concentrations of Tramadol resulting from oral administration, the W_{50} value: "The W_{50} parameter defines the width of the plasma profile at 50% C_{max}, *i.e.*, the duration over which the plasma concentrations are equal to or greater than 50% of the peak concentration." (col. 3, lines 9-15). It is my understanding as one of ordinary skill in the art that the W_{50} parameter helps to define the *in vivo* characteristics, *i.e.*, the therapeutic effect, of the controlled release Tramadol preparations described in the patents.

32. By way of another example, Figures 1 and 2 of the specification describe the results of *in vivo* studies involving formulations for controlled release Tramadol derived from the patent. Figure 1 depicts the serum levels of Tramadol following administration of one tablet according to Example 2 in twelve healthy volunteers. (col. 8, lines 5-8). Figure 2 depicts the plasma profile resulting from single dose administration of the tablet of Example 8 in comparison to the administration of a commercial, conventional preparation of Tramadol drops in five healthy male volunteers. (col. 8, lines 8-12). It is my understanding as one of ordinary skill in the art that blood plasma profiles and clinical results help to define the *in vivo* characteristics, *i.e.*, the therapeutic effect, of the controlled release Tramadol preparations described in the patents.

Matrix

33. One of ordinary skill in the art would recognize that the term "matrix" in the patents in suit has its ordinary meaning. That is, a pharmaceutical preparation that incorporates an active ingredient dispersed within a solid dosage form. Plaintiffs' proposal that "matrix" means "a pharmaceutical preparation that incorporates the active ingredient dispersed

within a solid dosage form" is consistent with my understanding as one of ordinary skill in the art.

34. One of ordinary skill would understand that the specification of the patents in suit describe both a normal release matrix and a controlled release matrix. (col. 3, lines 40-47). One of ordinary skill would also understand that a controlled release matrix may control the release of the active ingredient through diffusion, disintegration, erosion, degradation, dissolution, and/or some other mechanism, or a combination of these. In contrast, one of ordinary skill in the art would understand that a normal release matrix is intended to release the active pharmaceutical ingredient similarly to an immediate release dosage form, *i.e.*, that it does not substantially impede the release of the active pharmaceutical ingredient.

35. By way of example, the '887 patent specification at column 3, line 48 – col. 4, line 19 describes suitable ingredients for inclusion in the controlled release matrix such as hydrophilic or hydrophobic polymers, digestible long chain substituted or unsubstituted hydrocarbons, *e.g.*, waxes and vegetable oils, as well as other pharmaceutically acceptable ingredients. Thus, one of ordinary skill in the art would understand that a matrix which may include, but not be limited to, excipients such as polymers, waxes, and oils, as well as other pharmaceutically acceptable materials, and that is shown to control the release of the active pharmaceutical ingredient, would be known as an example of a controlled release matrix.

Normal release matrix

36. One of ordinary skill in the art would understand from reading the claims in the context of the specification that the term "normal release matrix" in the patents in suit refers to a matrix that acts as an immediate release matrix. That is, a normal release matrix is a matrix that does not substantially impede the release of the active pharmaceutical ingredient.

Plaintiffs' proposal that "normal release matrix" means "a matrix that does not substantially slow the release of the active ingredient" is consistent with my understanding as one of ordinary skill in the art.

37. One of ordinary skill in the art understands that excipients are used in pharmaceutical formulations. These inert ingredients, even in an immediate release formulation, may slow or impede to some extent, the release of the active ingredient. However, compared to a controlled release formulation, the release of the active ingredient is not substantially impeded.

38. The specification states that "normal release matrices having a coating which provides for controlled release of the active ingredient may be used" (col. 3, lines 45-47), and that "the controlled release preparation according to the invention may comprise a normal release matrix having a controlled release coating" (col. 4, lines 24-28).

39. From these specification passages, one of ordinary skill in the art would understand that a normal release matrix within a controlled release preparation does not substantially impede the release of the active ingredient, but rather may additionally have a coating that provides for controlled release of the active ingredient.

A pharmaceutically effective amount of tramadol or a salt thereof

40. One of ordinary skill in the art would understand from reading the claims in the context of the specification that the phrase "a pharmaceutically effective amount of tramadol or a salt thereof" has its ordinary meaning. Plaintiffs' proposal that "a pharmaceutically effective amount of tramadol or a salt thereof" means "an amount of tramadol or a salt thereof sufficient to provide at least some analgesia" is consistent with my understanding as a person of ordinary skill in the art.

41. As discussed above, Tramadol is an orally active analgesic. (col. 1, lines 10-12). The specification states that the "controlled release preparation according to the invention preferably contains an analgesically effective amount of tramadol or a pharmaceutically acceptable salt thereof. . . ." (col. 3, lines 27-32). One of ordinary skill in the art would understand that a pharmaceutically effective amount of the active ingredient, tramadol or a salt thereof, would provide at least some analgesia.

42. In reading claim 1 of the '887 patent, the entire claim element of claim 1 states "a substrate comprising a pharmaceutically effective amount . . .." (col. 12, lines 18-19). One of ordinary skill in the art, reading claim 1 would understand the plain language of this element to mean that a substrate includes a pharmaceutically effective amount of Tramadol or a salt thereof.

43. Similarly, in '887 claims 13 and 14, the claim states "a *tablet* comprising a pharmaceutically effective amount . . .." One of ordinary skill in the art, reading claims 13 and 14 would understand the plain language of this element to mean that a tablet includes a pharmaceutically effective amount of Tramadol or a salt thereof.

Therapeutic effect for about 24 hours after oral administration

44. One of ordinary skill in the art would understand from reading the claims in the context of the specification that the phrase "therapeutic effect for about 24 hours after oral administration" has its ordinary meaning. The meaning of "therapeutic effect" to one of ordinary skill in the art was discussed above. The claim phrase "for about 24 hours after oral administration" has no special meaning to one of ordinary skill in the art. Plaintiffs' proposal that this term means "effective for the treatment of one or more clinical conditions, *e.g.*, pain, for

about 24 hours after oral administration" is consistent with my understanding as one of ordinary skill in the art.

Therapeutic effect for at least about 24 hours

45. One of ordinary skill in the art would understand from reading the claims in the context of the specification that the phrase "therapeutic effect for at least about 24 hours after oral administration" has its ordinary meaning. One of ordinary skill would understand this phrase to require a therapeutic effect for at least 24 hours. Plaintiffs' proposal that this term means "effective for the treatment of one or more clinical conditions, *e.g.*, pain, for at least about 24 hours after oral administration" is consistent with my understanding as one of ordinary skill in the art.

I declare under penalty of perjury pursuant to the laws of the United States of America that the foregoing is true and correct. Executed on June 13, 2008 in Nottingham, England.

MARTYN C. DAVIES

CERTIFICATE OF SERVICE

I hereby certify that on June 13, 2008, I caused the foregoing to be electronically filed with the Clerk of the Court using CM/ECF, which will send notification of such filing to:

Frederick L. Cottrell, III, Esquire
Steven J. Fineman, Esquire
RICHARDS, LAYTON & FINGER, P.A.

Richard D. Kirk, Esquire
BAYARD, P.A.

Mary W. Bourke, Esquire
CONNOLLY BOVE LODGE & HUTZ LLP

I further certify that I caused to be served copies of the foregoing document on June 13, 2008, upon the following in the manner indicated:

Frederick L. Cottrell, III, Esquire — *VIA ELECTRONIC MAIL AND HAND DELIVERY*
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/s/ Rodger D. Smith II

Rodger D. Smith II (#3778)

EXHIBIT 1

CURRICULUM VITAE

Martyn Christopher Davies BSc PhD
FRPharmS CChem FRSC

Professor in Biomedical Surface Chemistry
Director, Laboratory of Biophysics and Surface Analysis

CURRICULUM VITAE

Professor Martyn Christopher Davies BSc PhD

Male: British; 50 years of age;
Born 6th February, 1957 in Pontypridd, South Wales.

Married Lesley Anne Davies MRPharmS, 23rd May 1987.
We have two children, Benjamin Tomus (17yrs) and Bethan Lucy Penelope (16yrs).

BUSINESS ADDRESS

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HOME ADDRESS

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EDUCATION

1977-1980 BSc (1st Class) at the Department of Pharmacy, Brighton Polytechnic final year project on "Applications of Synthetic Biomedical Polymers in Advanced Drug Delivery" (with Professor C Marriott).

1981-1984 PhD studies on the Surface Energetics of Hydroxypropylmethylcellulose, entitled "Properties of aqueous film coatings". (Supervisor - Professor J M Newton) at the Chelsea School of Pharmacy, Kings College, University of London, awarded 1985.

EMPLOYMENT RECORD

1981 Pre-registration pharmacy graduate at Pharmacy Department, University College Hospital, London (six months), and Research and Development Department, Roche Products Ltd., Welwyn Garden City, Herts (six months).

1984-1985 Department of Pharmacy, University of Manchester.
Temporary Lecturer with responsibilities for teaching physical chemistry.

1985-1991 Department of Pharmaceutical Sciences, University of Nottingham.
Lectureship in Drug Delivery.

1991-1996 Readership in Biomedical Surface Chemistry.

1996- Professor of Biomedical Surface Chemistry

1999-2000 Deputy Head of School of Pharmaceutical Sciences

2000-2003 Head, The School of Pharmaceutical Sciences and The Pharmacy School

NATIONAL OR INTERNATIONAL RECOGNITION

(A) DISTINCTIONS AND PRIZES

1980 Awarded the Edmund White prize for Best Pharmacy student of the final year at Brighton Polytechnic in June 1980.

1988 Recipient of the 1988 Pharmatec prize ($5,000) for novel work in the Pharmaceutical Sciences in recognition of my surface analysis studies.

1991 Recipient of one of the five 1991 Pfizer Academic Awards in recognition of the excellence of my recently published research (£5,000). The citation reads "For his contribution to the structural characterization of pharmaceuticals and biomaterials through surface analysis to optimize the rational design of drug delivery systems".

1994 Recipient of the UK ESCA Users' Group Science Prize. The citation reads "for work which has been judged to be of outstanding quality and an important contribution to the field of surface science".

1997 Recipient of Controlled Release Society's Young Investigator Award in recognition for my studies on probing biomolecular interactions with materials using surface analytical techniques.

2000 Science Chairman, Millennium Meeting British Pharmaceutical Conference, Birmingham International Conference Centre (1700 attendees).

2001 Scientific Secretary, Controlled Release Society.

2003 Fellow of the Royal Society of Chemistry
Fellow of the American Institute for Medical and Biological Engineering
Recipient of the GlaxoSmithKline International Achievement Award 2003 presented at the British Pharmaceutical Conference September 2003
Fellow of the Royal Pharmaceutical Society of Great Britain

2005 Member for RAE 2008 Pharmacy Sub-Panel

2007 The Queen's Awards for Enterprise: Innovation 2007. Awarded to Molecular Profiles and The Pharmacy School in recognition for continuous innovation.

Our Group has attracted recognition from within the University being chosen to host visits from dignitaries (The Secretaries of State for Education and Trade and Industries - John Patten and Michael Heseltine; The Chief Scientific Officer to the Cabinet; Sir Mark Richmond; Sir Richard Sykes, Chairman of GlaxoSmithKline on opening of the GSK Nanotechnology Laboratory; Professor Aaron Klug, President of Royal Society on occasion of opening Institute of Pharmaceutical Sciences; The Chief Executive of the

BBSRC - Professor R Baker; Science Minister - Lord Sainsbury) reviewing technology transfer exploitation within the School and to advertise the research profile of the University, the City and DTI Link Schemes by contributions in scientific brochures. The Group contributed by invitation to an Exhibition on Nanotechnology at the Science Museum and have been invited to be hosts of a number of national scientific and professional meetings.

(B) INVITATIONS TO ADDRESS CONFERENCES AND LEARNED SOCIETIES

Over the last eighteen years, I have had a number of invitations to address conferences and learned societies at a national and international level. A selection are shown below:

1987
- Surface analysis techniques, Drug Delivery Workshop, **Controlled Release Society**, Virginia, USA.
- Surface Characterization of Biomaterials, **American Chemical Society**, Surface and Colloid Science division, Ann Arbor, USA.
- Spectroscopy of Polymers, a **Royal Society of Chemistry** (MACRO Group) Meeting in honour of Professor Irwin, Grasmere.
- Life Science Group, **Eastman Kodak Laboratories**, Rochester, USA.

1988
- **Biomaterials Symposium**, University of Toronto, Canada.

1989
- Surface Characterization of Pharmaceuticals, **Royal Society of Chemistry** meeting, Bradford University.
- Interfaces in Biomaterials Sciences, **European Materials Conference**, Strasbourg, France.
- Polymer Latex 89, **Rubber and Plastics Research Association**, London.
- New Analytical Techniques for Polymer Analysis, **Royal Society of Chemistry** meeting, Loughborough University.

1990
- 10th Celebration meeting, **UK ESCA User Group**, ICI Advanced Materials Centre, Wilton, Middlesborough.
- Characterization of Macromolecules used as Pharmaceutical Excipients, **Swedish Academy of Sciences**, Gothenburg.
- Polymer surfaces, **American Chemical Society** symposium, Boston, USA.
- STM of biomolecules, **Royal Society of Chemistry** meeting, Nottingham University.
- Technical Forum, **3M**, Loughborough.

1991
- Polymer Surface and Interfaces II, **Royal Society of Chemistry** and MACRO group meeting, Durham University.
- Surface science in the 1990's, **UKESCA Users Group**, Surrey University.

1992
- Polymer surface analysis, **Royal Society of Chemistry** meeting, UMIST.
- Surfaces and properties of biomaterials, **Joint Kodak/CSMA** meeting, UMIST.
- Surface analysis of biomaterials, **World Congress of Biomaterials**, Germany.
- Molecular Surfaces symposium, **American Vacuum Society**, Germany.

1993
- Science Link, **National Association of British Science**, University of Keele.
- Biomaterial Interfaces Symposium, **American Chemical Society** Meeting, Chicago, USA.

1994
- **AMES Symposium**, Department of Chemistry, University of Edinburgh.

- Visiting Lecture Programme, sponsored by **Courtaulds Group Research**.
- Interactions at Surfaces, **Royal Society of Chemistry** Symposium, Imperial College, University of London.

1995
- **Eidgenossiche Technische Hochschule** (ETH), Zurich.
- Biomedical Polymer Surfaces Symposium, **American Chemical Society**, Anaheim.
- Surface Contamination Meeting, **Centre for Material and Surface Analysis**, Manchester, September.
- New Opportunities in Surface Science, **Interdisciplinary Research Centre in Surface Science**, University of Liverpool, October.
- Biomaterial Interfaces at the Nanoscale, **American Vacuum Society**, Minneapolis, November.
- Groupe Thematique de Recherche sur les Vecteurs, **National French Advanced Drug Delivery Society,** Agen, December.

1996
- Colloids Characterization Symposium, **International Pharmaceutical Association**, March 7 - 9, Mainz, Germany.

1997
- **American Chemical Society symposium**, San Francisco, April 1997.
- Surface analysis of biomaterials, **ECASIA 97**, Gothenburg, June 1997

1998
- Biocolloids, **Royal Soceity of Chemistry-Faraday Division**, University of East Anglia, April 1998.
- **5 th General Meeting of the Belgian Polymer Group**, Universiteit Gent, Ooestende. May 14th-15th 1998
- **Israel Controlled Release Society**, Jerusalem, September 1998.

1999
- **The 3rd International Symposium on Frontiers in Biomedical Polymers including Polymer Therapeutics**, Hotel Lake Biwa, May 23rd-27th Japan.
- **SIMS XII International Conference on Secondary Ion Mass Spectrometry and Related Topics**, Brussels, September 5th-10th 1999.

2000
- **Millennium Microscopy Meeting**, Open University, Middlesex, February 3rd-4th 2000
- **Institute of Physics Congress**, Brighton, March 27th-30th 2000. (Dr CJ Roberts deputised)
- **Croucher Foundation Advanced Study Institute in Frontiers in Surface Analysis and their novel applications**, Hong Kong May 14th-19th 2000 (Dr PM Williams deputised)
- **10th International Conference on Colloid and Interface Science**, Bristol, 23rd-28th July 2000.
- **Millennium Science Conference of Royal Pharmaceutical Society of Great Britain,** Birmingham International Conference Centre, September 10-13th, 2000.
- **47th International Symposium American Vacuum Society,** Boston MA, October 2nd-6th 2000.
- **Special Interest Group Research of the Institute of Food Science & Technology, South Bank University**, London 11th October 2000 (Dr PM Williams deputised).

2001
- **10th International Symposium on Recent Advances in Drug Delivery Systems,** Salt Lake City**,** 19th-22nd February 2001.
- **6th International Symposium on Polymers for Advanced Technology,** Jerusalem, 3rd-7th September 2001
- **AAPS 2001 Annual Meeting**, Colorado, USA, 21st-25th October 2001.

2002 - **5th International Symposium on Polymer Therapeutics: From Laboratory to Clinical Practice**, Wales, 3rd-5th January 2002
- **29th Annual Meeting Controlled Release Society**, Seoul, Korea, 20-25 July 2002

2003 - **AstraZeneca STAT Complex Parenterals Symposium**, Macclesfield
- **Joint CRS-Utah Polymer Therapeutics Meeting – Biomolecular interactions in drug delivery**, March 3rd-6th 2003
- **PITTCON 2003 – Advances in Scanning Force Microscopy: Towards Molecular Recognition Imaging" Symposium**, Orlando, USA, 8th-14th March 2003 (Dr P M Williams deputized)
- **30th Annual Meeting Controlled Release Society**, Glasgow, 19th-23rd July 2003

2004 - **RSC Biological Interactions at Surfaces:Chemistry and Biomaterials Workshop**, London, 15th January 2004
- **31st Annual Meeting Controlled Release Society**, Hawaii, 12th-16th June 2004
- **IUPAC 40th International Symposium on Macromolecules**, Paris 4th-9th July 2004
- **51st American Vacuum Society Symposium,** Anaheim, USA, 14th-19th November 2004
- **BioLiège Bioforum**, Liège, Belgium, 30th November 2004
- **Australasian Pharmaceutical Science Association,** Melbourne, 4th-7th December 2004

2005 - **12th International Symposium on Recent Advances in Drug Delivery Systems**, Salt Lake City, 21st-24th February 2005
- **32nd Annual Meeting Controlled Release Society**, Miami, 20th-22nd June 2005
- **First International Symposium on Biointerface Science**, New Bern, USA,12th-14th May 2005
- **3rd Nanomedicine Conference**, Baltimore, 25th-27th September 2005

2006 - **Celebrating 30 Years of Robert Langer's Science**, Boston, 14th July 2006
- **Gordon Research Conference**, Montana 20-25th August 2006
- **Immobilization of drugs onto polymer substrates and controlled drugs release**, Iasi, Romania 2006
- **29th Macromolecular Symposium**, Hamburg, 1st-4th October 2006

I have also presented seminars at a number of **UNIVERSITY DEPARTMENTS AND RESEARCH INSTITUTES INCLUDING**:

Materials Science	- Surrey, Sheffield and London (Queen Mary and Westfield) Universities.
Chemistry	- Edinburgh, UMIST, Nottingham, Reading, Bristol and Gent Universities
Pharmacy	- Manchester, Nottingham, UMIST, Strathclyde, Bath, Aston, Cardiff, Marburg, Utah, Regensburg and London (Kings College and The School of Pharmacy) Universities.
Biochemistry	- Keele University
Biophysics	- The Randall Institute, Kings College, London University
Physics	- The Cavendish Laboratory, Cambridge
University	

I have also presented lectures to a number of research groups within the Pharmaceutical and Chemical Industry including Ciba Geigy, Cyanamid, Glaxo, Merck, Sharp and Dohme, Courtaulds, SmithKline Beecham, Pfizer, Astra Zeneca and Roche.

(C) EXTERNAL EXAMINERSHIPS AND REFEREE DUTIES

(I) EXTERNAL EXAMINER - UNDERGRADUATE STUDIES

1993-1997 - Physical and Surface Chemistry, Biopharmaceutics, Pharmaceutical Technology and Advanced Drug Delivery modules of the BPharm degree, The School of Pharmacy, Kings College, University of London.

2003-2007 - MSc Pharmaceutical Technology, School of Pharmacy, King's College London

2003-2007 - The School of Chemical Sciences and Pharmacy, University of East Anglia

2004-2007 - The School of Pharmacy and Pharmacology, University of Bath

(II) EXTERNAL EXAMINER - POSTGRADUATE STUDIES

External PhD examiner at the following Departments and Universities:

Pharmacy	- University of Wales at Cardiff. - University of Bath - University of Belfast - Kings College, University of London (4) - University of East Anglia
Chemistry	- University of Durham (2) - University of Southampton (MPhil) - University of Manchester Institute of Science and Technology (2) - University of Coleraine - Sheffield Hallam University - Catholic University of Louvain
Physics	- HH Wills Laboratories, University of Bristol (2) - DeMontfort University - The Cavendish Laboratory, University of Cambridge
Biotechnology	- Institute of Biotechnology, University of Cambridge (2)
Materials Sci.	- University of Sheffield (3) - University of Surrey
Chemical Engineering	- Imperial College, London

I have also acted as internal examiner to numerous PhD viva-voce examinations within the School of Pharmacy.

(III) REFEREE - JOURNALS

I regularly act as a referee for a variety of surface, analytical, biomaterials, biophysical and pharmaceutical journals including:

Analytical Chemistry, Colloids and Surfaces, Surface and Interface Analysis, Biomaterials, Journal of Colloid and Interfacial Science, Pharmaceutical Research, Journal of Microscopy, Carbohydrate Polymers, Biomaterials, Journal of Controlled Release, Macromolecules, Langmuir and Materials in Medicine.

(IV) REFEREE - RESEARCH GRANTS

Since 1987, I have been asked to act as referee for numerous grant applications:

BBSRC, EPSRC, AFRC, Leverhulme Trust, The Welcome Trust and Medical Research Council.

I was a member of the Medical Engineering Subcommittee, Materials Commission, EPSRC (1995-1997).

I am a member of the EPSRC Life Sciences College (1999-).

RPSGB Academic Excellence Awards Panel member (2006)

(V) CONFERENCE/MEETING ORGANISATION SINCE 1990

1990 Co-organiser and host of **Royal Society of Chemistry** Biological Methods Group "1st UK International Meeting on Biological Applications of STM". Nottingham 23-24th September 1990 (165 Participants).

1993 Co-organiser and host for **Department of Trade and Industry** "New Business Opportunities in Nanotechnology and Biosciences Workshop" on "Scanning Probe Microscopy". Nottingham 1st September 1993 (15 participants).

1994 Organiser and host of **UK ESCA User Group** Meeting "Honey, I shrunk the sample", Nottingham 14th January 1994 (115 participants).
Co-organiser and host of **Royal Society of Chemistry** Biological Methods Group Meeting on "Surface Plasmon Resonance: current applications and new horizons". Nottingham 11th July 1994 (80 participants).

1995 Co-organiser and host, Inaugural **UK Controlled Release Society** Meeting "Controlled Release in the UK - current perspectives and future horizons", Nottingham, Jan 9th, 1995 (140 participants)

Co-organiser of **Controlled Release Society** Meeting Workshop "Novel approaches to biomaterials characterisation", Seattle, July 30th - August 2nd 1995.

Organiser and host of the **Royal Microscopic Society** "Scanning Probe Microscopy", Nottingham, April 24-25th, 1995

Co-organiser and host of the **EPSRC Nanotechnology** Meeting "Biological Applications of Nanotechnology", Nottingham, June, 1995.

Member of Organising Committee, **European Biomaterials Conference**, Porto, September 1995.

2000 Science Chairman, Millennium meeting of **British Pharmaceutical Conference**, Royal Pharmaceutical Society of Great Britain, Birmingham International Convention Centre, September 2000 (1700 attendees).

Co-organiser (with Dr Jane Lawrence, Kings College, University of London), Biological Sessions, and Member of Organising Committee, **10th International Conference on Colloid & Interface Science**, Bristol, June 2000 (150-200 attendees in sessions).

Symposium Session Organiser, "**The Genomic Revolution; an update"; British Pharmaceutical Conference, Royal Pharmaceutical Society of Great Britain**. Glasgow Conference Centre, September 2001.

2001 Member of Advisory Board for the **5th International Symposium on Polymer Therapeutics: From Laboratory to Clinical Practice** (with Ruth Duncan and Helmut Ringsdorf & International Advisory Committee), Welsh School of Pharmacy, Cardiff University 3-5 January 2002.

2002 Scientific Secretary, **29th Annual Meeting Controlled Release Society**, July 20-25, Seoul, Korea
Organising Committee and Session Chair, **Surface Engineering for Competitive Advantage, Advanced Materials Research Institute**

2003 Programme Organising (with J Kopeck, K Park, J Anderson, S-J Lee), **Joint CRS-Utah Polymer Therapeutics Meeting**, March 3-5
Scientific Secretary, **30th Annual Meeting Controlled Release Society**, July 19-23, Glasgow
Special Drug Delivery Session in Honour of Bob Davis, **British Pharmaceutical Conference**, Harrogate, September 15-17

2004 Scientific Secretary, **31st Annual Meeting Controlled Release Society**, 12th-16th June 2004, Hawaii, USA

2005 Organising Committee, **3rd Symposium on Nanomedicine and Drug Delivery**, October 2005, Baltimore
Scientific Secretary, **32nd Annual Meeting Controlled Release Society**, 20-22nd June, Miami, USA

2006 Scientific Secretary, **33rd Annual Meeting Controlled Release Society**, Vienna, 22nd-6th July 2006
Organising Committee, **4th International Nanomedicine and Drug Delivery Symposium**, Omaha, 8-10th October 2006

2007 Scientific Secretary, **34th Annual Meeting Controlled Release Society**, Long Beach, 7th-12th July 2007

2008 Scientific Secretary, **35th Annual Meeting Controlled Release Society**, New York, 12th-16th July 2008

(VI) SERVICE TO PROFESSIONAL AND LEARNED SOCIETIES

Member of UK ESCA Users Group Committee (1991-95)

Founder of the UK Controlled Release Society, Acting-Chairman of the Steering Committee, Elected Secretary (1994-97); Organiser of Inaugural Meeting.

Member of the Controlled Release Society Best Conference Paper Committee (1993-96) and Global Chapters Committee (1994-7)

Member of the Biomaterial Interfaces Committee of the American Vacuum Society (1994-99; 2000-).

Member of the Board of Governors, Controlled Release Society (1997-2000)

Member, National Initiative Drug Delivery, Royal Pharmaceutical Society of Great Britain (1998-).

Member, Academy of Pharmaceutical Sciences and Science Committees, Royal Pharmaceutical Society of Great Britain (1998-2000)

Member, Science Committee, Royal Pharmaceutical Society of Great Britain (1999-2001).

Scientific Secretary and Member of Board, Controlled Release Society (2001-)

Fellow, American Institute for Medical and Biological Engineering (2003-)

Member, Acadamy of Pharmaceutical Sciences Advisory Board (2003-)

Member, Royal Society of Medicine (2007-)

(VII) MEMBERSHIP OF EDITORIAL BOARDS

Editor: Nanobiology (1993-1999)
Guest Editor: The Analyst (1994: Scanning Probe Microscopy Edition)
Editorial Board: Advanced Drug Delivery Reviews (2000-), European Journal of Pharmaceutical Sciences (2001-), Journal of Controlled Release (2004-

(VII) MEMBERSHIP OF LEARNED SOCIETIES

Royal Pharmaceutical Society of Great Britain, Royal Society of Chemistry, Royal Society of Medicine, American Chemical Society, American Vacuum Society, American Association of Pharmaceutical Scientists, Controlled Release Society, Royal Microscopic Society, UK Academy of Pharmaceutical Scientists, UK ESCA and SPM User Groups

(VIII) DIRECTORSHIPS & INDUSTRIAL ADVISORY BOARDS

Co-Founder, Director and Chairman, Molecular Profiles Limited (1998-).
Co-Founder of Regentec Limited (2001-)
Director, Critical Pharmaceuticals Limited (2007-)

DEPARTMENTAL and UNIVERSITY DUTIES

DEPARTMENT DUTIES

- Head, The Pharmacy School and The School of Pharmaceutical Sciences (2000-2003)
- Deputy-Head, School of Pharmacy (1997-2000)
- Chair, Departmental Postgraduate Committee (1997-9)
- Chair, Institute of Pharmaceutical Sciences Development Committee (1997-2000)
- Department Postgraduate Tutor (1989-96)
- Member, Department Management Group (1995-)
- Coordinator, Drug Delivery section of undergraduate course (1985-96)
- Member, Departmental Strategy Group (1993-)
- Member, Course Review Committee (1993-98)
- Member, Curriculum Review Committee (1994-97)
- Member, Research Committee, Teaching Quality Audit (1993-99)
- Undergraduate admissions (1985-)
- Academic Tutor and Mentor (1985-)

UNIVERSITY DUTIES

- Vice Dean, Health Sciences, Life Sciences and Agricultural Division (43 Depts) Nottingham University Graduate School (1995-97)
- Chair, University Postgraduate Training Committee (1996-98)
- Member of 19 University Appointment Boards for lectureships and Professorial chairs (1987-)
- Member, University Student Affairs Committee (1995-97)
- Member, Science, Agricultural and Medical Postgraduate Studies Committees (1995-1998)
- Member, Strategy Group for Information Services Committee (1999-2003).
- Member, Materials Strategy Committee (1998-2001).
- Member, Technical Grading Panel (2000-2003)
- Member, Senate (2000-2003)

RESEARCH SUPERVISION

(A) POSTGRADUATE STUDENTS (8 CURRENT; OVER 67 SINCE 1985)

From 1986, I have co-supervised over 60 PhD students to successfully complete and defend their PhD thesis. Many have gone onto postdoctoral fellowships (including Nottingham (4), Cambridge, Strathclyde, Surrey, London, MIT, ETH (Zurich), University of Washington, Georgia Institute of Technology, University of Michigan), many hold prominent posts within the Pharmaceutical, Chemical, Polymer & Diagnostics Industries and 1 has moved successfully into Pharmacy Management. My first student is now Director for Drug Delivery of a multinational pharmaceutical company.

I am currently co-supervising 8 PhD students (2, 4, 2 in the 1st, 2nd and 3rd year respectively).

(B) POSTDOCTORAL RESEARCH WORKERS (6 CURRENT, OVER 37 SINCE 1985)

I have co-supervised more than 37 postdoctoral fellows since 1985 whose previous scientific training ranged from Biochemistry, Surface Science, Polymer Chemistry,

Electronic Engineering, Biophysics, Physics, Physical Chemistry, Analytical Chemistry and Pharmaceutical Sciences.

I am proud that 15 have moved onto academic postions in University Science (7) and Pharmacy (8) Departments and three hold personal chairs (Professors) in RAE grade 5 Schools. Some have moved onto further prestigious postdoctoral fellowships, where 2 have been awarded a BBSRC Advanced Training Fellowship and 2 have been awarded an EPSRC Advanced Training Fellowship.

I currently co-supervise the work of 6 postdoctoral research fellows within my research group.

RESEARCH GRANTS and CONTRACTS

(I) SPECIAL RESEARCH STUDENTSHIPS AWARDED

1985 - SERC Quota studentship.
1986 - 2 SERC Quota studentships.
1987 - 2 SERC Case awards with Cyanamid and Polymer Laboratories.
1988 - 2 SERC Instant and 2 SERC Quota awards.
1989 - 2 SERC Quotas and 1 SERC Instant award.
1990 - SERC Case award with Celltech, 1 EEC Brite awards, and 1 from industry (Dow).
1991 - 2 EEC Brite awards, 1 MAFF/DTI award and 2 from industry (Viggo, Kelco).
1992 - SERC Quota award, 1 EEC Brite award and 1 MAFF/DTI award.
1993 - 1 EEC Brite awards, 1 SERC Case award with SmithKlineBeecham and one award from industry (Courtaulds)
1994 - 1 SERC Case Award with Kodak Ltd, SERC Quota award and one award from industry (Alpha Beta Ltd)
1995 - 1 BBSRC Quota award, 2 Departmental CASE awards (Oxford Molecular Ltd and SmithKline Beecham), one award from industry (Lilly Group Research)
1996 - 2 BBSRC Quota awards and 2 BBSRC Case awards (SmithKline Beecham and Severn Trent)
1997 - BBSRC Quota awards, 1 BBSRC and EPSRC Case awards (SmithKline Beecham and Biocompatibles Ltd). 1 special EPSRC studentship unfilled.
1998 - BBSRC Quota award and EPSRC Case Awards (Smithkline Beecham) and 2 University awards.
1999 - BBSRC Case award (Glaxo Wellcome)
2000 - BBSRC Case award (Biocompatibles)
2001 - 1 BBSRC Quota award, 1 BBSRC Committee Studentship – "Nanometre-scale surface chemical characterization of engineered biomimetic materials"
2002 - BBSRC Committee Studentship – "Molecular-scale characterization of Gene Therapy Delivery Systems"
2003 - BBSRC Case Award (GlaxoSmithKline), EPSRC Case Award (Avecia)
2005 - BBSRC Strategic Studentship "Nanoscale analysis of polymer microarrays for biomaterial stem cell interaction"

(II) GENERAL RESEARCH AWARDS

The detailed list of the general research awards obtained since 1985 is shown below. Most are collaborative with grants with colleagues in the Laboratory of Biophysics & Surface Analysis. No contract research awards are shown.

1986	£2,000	**Nuffield Foundation Award**. "The surface analysis of oral vaccines".
	£4,290	**SERC**, award for studies at SERC regional centre,"Surface analysis of biomaterials and pharmaceuticals with SIMS".
1987	£36,205	**SERC**, "ToF-SIMS analysis of protein adsorption".
	£41,000	**SERC**, "Colloidal carriers for drug targeting", (cooperative award with ICI Pharmaceuticals); (with Prof S S Davis).
	£23,500	**Reckitt and Colman**, "Novel microparticulate systems for oral drug delivery".
	£9,000	**Cyanamid**, "Polymer-drug-conjugates", (with Drs P.N.Shaw and I.S.Blagbrough).
	£7,000	**Polymer Laboratories** "Immobilization of biomolecules to colloid surfaces".
	£42,000	**Pharmatec** "Controlled release of drugs from polymeric matrices", (with Dr C.D.Melia and Prof S.S.Davis).
1988	£60,000	**MRC**, "Colloidal systems for aids vaccine" (with Dr P Williams and Prof S S Davis).
	£30,000	**WHO**, "Particulate systems as oral vaccines" (with Dr P Williams and Prof S S Davis).
	£67,775	**SERC Grant** "The Selective Delivery of Drug Carriers to Bone Marrow" (with Prof SS Davis and Dr PM Williams)
1989	£15,000	**Reckitt and Colman** "Novel microparticulate systems for oral drug delivery", (with Drs C Wilson and CD Melia).
	£5,000	**Courtaulds Research**, contribution towards SERC Case award, "FT-Raman spectroscopy of biomaterials".
	£33,950	**SERC**, "ToF-SIMS analysis of polymeric biomaterials and pharmaceuticals".
	£67,653	**SERC**, (1989-1992) "Drug targeting to tissue sites using colloidal delivery systems: phase 2 Biodegradable colloids" (with Profs SS Davis and L Illum)
1990	£40,000	**SERC**, "SIMS analysis of biomaterials"(with Profs SS Davis and JV Wood).
	£46,000	**SERC**, "Novel microparticles for colonic drug delivery", (cooperative award with Reckitt and Colman); (with Drs CD Melia, CG Wilson and R Spiller).
	£32,000	**Dow (Europe)** "Controlled release of drugs from novel polymer systems", (with Dr CD Melia).
	£52,000	**SERC**, "Biodegradable colloids for drug targeting", (cooperative award with ICI Pharmaceuticals); (with Prof SS Davis).

	£80,000	**EEC BRITE award**, "Surface analysis of hydroxyapatite biomaterials coatings".
	£620,000	**EEC BRITE** award "Novel surface coatings for colloidal particulates", (with Prof SS Davis).
	£6,000	**Celltech** "STM of monoclonal antibodies", (with Dr SJB Tendler).
1991	£1,032,000	**MAFF/DTI /LINK** Scheme "The hydration of food and pharmaceutical systems in food and pharmaceutical industries" (with Drs CD Melia, DE Jackson and J Mitchell).
	£58,000	**SERC** "Surface characterization and chromatographic behaviour of alkyl bonded silaceous chromatographic materials", (with Drs P N Shaw and D Barrett).
	£420,000	**SERC/DTI LINK** scheme "The development of scanning tunnelling microscopy into a biophysical tool for the investigation of protein structure and function" with VG Microtech and Glaxo Group Research (with Drs S J B Tendler and D E Jackson).
	£91,000	**Kelco International** "A study of hydrophilic characteristics of alginate and xanthan"(with Drs J R Mitchell and C D Melia).
	£39,000	**Viggo-Spectramed** "Surface interaction of drugs with polymers".
	£15,000	**Dow** (Europe), additional funds for the project, "Controlled release of drugs from novel polymer systems", (with Dr C.D.Melia).
1992	£111,640	**SERC Teaching company scheme** "Colon drug delivery" (with Drs Spiller, Wiseman, and Haresign) with Danbiosyst.
	£87,000	**EEC BRITE** award "Design and evaluation of a heparin adsorbing filter for application in extracorporeal haemodialysis" in collaboration with the Universities of Gent and Brescia [At Nottingham].
	£140,000	**EEC BRITE** award "The development of improved biocompatible materials for urological and other medical devices" in collaboration with Kodak Ltd, Fidia spa, Universities of Naples, Brighton and Gent and St Bartholomews Hospital. [At Nottingham]
1993	£742,000	**SERC/DTI LINK** scheme, Nanotechnology initiative "The development of atomic force microscopy for biomedical applications in nanotechnology" with Kodak Ltd, VG Microtech, and Oxford Molecular. Equipment donated by Hewlett Packard (with Drs S J B Tendler and D E Jackson).
	£82,798	**SERC** "Surface modification of porous graphitic carbon as a chromatographic support for the separation of chiral and polar compounds" with Shandon Scientific (with Drs P N Shaw and D Barrett).

	£45,000	**SERC** "An integrated surface plasmon resonance / scanning probe microscope for biomolecular analysis" (with Drs S J B Tendler and D E Jackson).
	£37,748	**Courtaulds** "Studentship to study the surface analysis of surfactant adsorption at polymer films" (with Dr S J B Tendler).
	£36,000	**SERC Case Award with SmithKline Beecham** "Scanning probe microscopy of biomolecular structure and function" (with Dr S J BTendler).
1994	£144,911	**SERC** "Novel polymer support materials for the chromatographic separation of biomolecules" with Polymer Laboratories (with Drs P N Shaw and D Barrett).
	£36,000	**Alpha-Beta Ltd** "Studentship on Scanning Probe Microscopy studies of novel polysaccharides" (with Dr S J B Tendler).
1995	£54,855	**EPSRC** (1995-1997) "Novel algorithms for the investigation and reconstruction of surface structure by scanning probe microscopy" (with S J B Tendler and C J Roberts).
	£38,000	**Lilly Group Research** (1995-1998) "Scanning probe microscopy of biomolecular structure" (with S J B Tendler and C J Roberts).
	£126,136	**BBSRC**, "Chromatographic materials for the specific separation of oligonucleotides and nucleic acids" (with Drs P N Shaw and D A Barrett).
	£24,641	**EPSRC Project Grant** (1995-1997) "Probing forces of molecular interactions" (with SJB Tendler and CJ Roberts).
	£36,000	**Oxford Molecular/University of Nottingham** (1995-1998) "Computational investigations of scanning probe microscopy" (with S J B Tendler and C.J.Roberts).
	£472,974	**EPSRC Project Grant** (1995-1999) "The development of a unique imaging TOFSIMS instrument with femtosecond laser positionization capability" (with Prof JC Vickerman and Drs CM Carr and GJ Leggett)
1996	£150,521	**EPSRC** (1996-1998) "The development of advanced analytical tools for the rapid screening of immobilized combinatorial libraries" (with S.J.B.Tendler and C.J. Roberts).
	£160,000	**Cancer Research Campaign Programme Grant** (1996-2000) "SPM Studies of drug-DNA interactions" (with S.J.B.Tendler and M.F.G. Stevens).
	£212,000	**BBSRC Equipment and Industry Initiative** "The development of a near-field optical probe technology into a biophysical tool for the study of biomolecular and biological systems". BBSRC £106,000, Topometrix Corporation £106,000.(with S.J.B.Tendler and C.J. Roberts).

£151,456 **BBSRC** Project Grant (1996-1999) "Probing and optimising immunosensor surfaces at the molecular level" (with S.J.B.Tendler, C.J. Roberts and Johnson and Johnson Clinical Diagnostics).

£60,000 **Hewlett-Packard** Instrument Donation (1996-1997) "Computational algorithms for scanning probe microscopy analysis" (with S.J.B.Tendler, C.J. Roberts and P.M. Williams).

£25,333 **EPSRC** Project Grant (1996-1997) "The characterization of refractive index in thin films to nanometre spatial resolution" (with S.J.B.Tendler, P.M. Williams and C.J. Roberts).

£14,000 **SmithKline Beecham plc** (1996-1999) "Scanning probe microscopy studies of biomolecular structure and function" (with S.J.B.Tendler and C.J. Roberts).

£15,000 **Severn Trent plc** (1996-1999) "Electrokinetic analysis - applications in pharmaceutical analysis" (with S.J.B.Tendler and C.J. Roberts).

£104,833 **Action Research** (1996-1999) " The role of protein interactions with novel polymers used in tissue repair" (with S.J.B.Tendler, S Downes and C.J.Roberts).

£30,000 **Royal Society Paul Instrument Fund** (1996-1997) "For the construction of a quantitative intermolecular force sensor" (with S.J.B.Tendler and C.J. Roberts).

£47,413 **Elan Corporation** (1996-1997) "Surface Chemistry of peptide grafted polymer surfaces" (with S J B Tendler and C.J.Roberts).

1997 £132,684 **BBSRC Project Grant** (1997-2000) "Atomic force microscopy characterisation of the molecular forces of adhesion in nucleic acids" (with S J B Tendler, C J Roberts and C Laughton).

£145, 656 **BBSRC Project Grant** (1997-2001) "The study of biomolecular and biomedical systems by near-field optical microscopy" (with S J B Tendler, C J Roberts and P M Williams).

£554,000 **BBSRC Link Scheme (Analytical Biotechnology Initiative)** (1997-2001) "Two-dimensional mapping of molecular interactions at the interfaces of next generation immunoassay systems"
£230,000 - BBSRC,
£264,000 - Johnson and Johnson Clinical Diagnostics,
£60,000 - Digital Instruments/LOT Oriel.
(with S J B Tendler, C.J. Roberts and P.M. Williams).

£59,129 **Glaxo Wellcome Project Grant** (1997-1998) "Biophysical evaluation of DNA-Lipid complexes" (with P M Williams, C J Roberts and S J B Tendler).

£14,000 **SmithKline Beecham plc** (1997-2000) "Surface characterization of drug crystals using novel atomic force

microscopy techniques" (with S J B Tendler, P.M.Williams and C.J. Roberts).

£15,000 **Biocompatibles plc** (1997-2000) "SPM studies of biocompatible surfaces" (with S J B Tendler, P.M. Williams and C.J. Roberts).

45,812 **EU Human Captital Mobility Award** "Study of Biointeractions at ECU functionalized polymeric surfaces" (with S.J.B.Tendler, C.J. Roberts and S O Vansteenkiste, Universiteit Gent, Belgium).

£30,000 **BBSRC Special Studentship** (1997-2000) "Regulation of peptide epitope and mimotope recognition by antibodies (with SJB Tendler and MR Price).

£147,121 **BBSRC Project Grant** (1999-2000), "The study of biomolecular and biomedical surfaces by near-field optical microscopy" (with SJB Tendler and CJ Roberts).

1998 182,000 **EU BRITE- EURAM Programme** "Lipostin". Partners ECU include Universities of Brighton, Gent, Naples and Milan (with S Howdle).

£43,000 **Elan Corporation Project Grant** "Surface Chemistry of peptide grafted polymer surfaces II" (with SJB Tendler, PM Williams and CJ Roberts).

£158,980 **BBSRC Project Grant** (1998-2001) "Spatially controlled cell engineering: A strategy to control nervous tissue micro-architecture" (with K Shakesheff, SJB Tendler, PM Williams and CJ Roberts).

£13,200 **University of Nottingham, Research Committee** "A bioengineering solution to the prevention of bacterial colonisation on biomaterials" (with K Shakesheff and Miguel Camara).

£251,328 **EPSRC Project Grant** (1998-2001) "Manufacturing of Biointeractive Scaffolds for Tissue Engineering using Supercritical Fluid Technology" (with SM Howdle & Kevin Shakesheff).

£15,000 **Oxford Molecular/BBSRC CASE Award** (1998-2001) "Computational studies on biomolecular recognition" (with SJB Tendler, CJ Roberts & PM Williams).

£30,000 **Royal Pharmaceutical Society Studentship** (1998-2001) "AFM studies of drug/DNA interactions" (with SJB Tendler, CJ Roberts & PM Williams).

£30,000 **BBSRC Special Studentship** (1998-2001) "Near-field probe microscopy of micro-patterned biomolecular surfaces in aqueous environments" (with SJB Tendler, CJ Roberts, & PM Williams).

	£30,000	**University of Nottingham/Orthoclinical Diagnostics Studentship** (1998-2001) "Manipulation of biomolecules by optical tweezers and probe microscopy in an epifluorescence optical microscope" (with SJB Tendler, CJ Roberts & PM Williams).
	£9,762	**Royal Society Equipment Award** (1998-1999) "Combined optical tweezers and atomic force microscopy" (with SJB Tendler, CJ Roberts & PM Williams).
	£51,202	**EPSRC Analytical Science Programme Project Grant** (1998-2001) "Analysis of near-field optical contrast: Chemical sensing at the nanoscale" (with SJB Tendler, CJ Roberts & PM Williams).
1999	£338,960	**EPSRC Project Grant** (1999-2002) "Instrumentation for the spatial analysis of reactions at interfaces" (with PM Williams, Dr CJ Roberts, SJB Tendler, KM Shakesheff).
	£173,648	**BBSRC Project Grant** (1999-2001) "The Dynamics of Biomolecules at Interfaces studied by Pulsed Force Atomic Force Microscopy" (with SJB Tendler, CJ Roberts, PM Williams).
	£37,000	**EPSRC Industrial Studentship with SmithKline Beecham** (1999-2002) "Initiation and growth of drug crystals" (with CJ Roberts, SJB Tendler, PM Williams, H Saibil, London).
	£251,328	**EPSRC Project Grant** (1999-2002) "Manufacturing of biointeractive scaffolds for tissue engineering using super critical fluid technology" (with Profs S Howdle and KM Shakesheff).
	£34,000	**BBSRC Special Studentship** (1999-2002) "3D reconstruction of structure" (with SJB Tendler, CJ Roberts, PM Williams).
	£2,200,00	**Joint Infrastructure Fund** (1999-2001) "New Institute of Pharmaceutical Sciences" (with BW Bycroft (Principle applicant) and SJB Tendler).
2000	£223,123	**EPSRC Multi User Equipment Grant** (2000-2002) "The thermal characterisation of materials at the sub-micron scale by scanning thermal microscopy" (with CJ Roberts, SJB Tendler, SM Howdle, KM Shakesheff, DM Grant, PM Williams, S Allen).
	£301,000	**BBSRC Project Grant** (2000-2003) "Cryogenic Force Microscopy of Biomolecular Structure" (with SJB Tendler, CJ Roberts, PM Williams, S Allen, Oxford Instrument and SmithKline Beecham).
	£153,540	**BBSRC Project Grant** (2000-2003) "The investigation of molecular interactions in ribonucleic acids" (with S Allen and SJB Tendler).
2001	£365,000	**EPSRC Strategic Equipment Initiative Grant** "Time-of-flight secondary ion mass spectrometry" (with D Briggs & M Chesters).
	£60,330	**EPSRC Project Grant** (2001-2004) "The development of a magnetically controlled force microscope, for high resolution

single molecule force spectroscopy" (with S Allen, CJ Roberts, SJB Tendler, PM Williams).

£348,903 **EPSRC Project Grant** (2001-2004) "The direct measurements of single macromolecule-membrane interactions" (with P O'Shea, & S Allen).

£229,428 **BBSRC Grant** (2001-2004) "Biomembrane force probe for mapping energy landscapes in protein interactions and folding" (with S Allen, SJB Tendler, P Williams & CJ Roberts).

2002 £653,331 **EPSRC Grant** (2002-2005) "Characterisation of Surfaces, Thin Films and Nanometre Scale Structures by X-Ray Photoelectron Spectroscopy" (with D Briggs, SJB Tendler, CJ Roberts, KM Shakesheff, MA Chesters, SM Howdle, Dr P Moriarty).

£109,756 **EU Marie Curie Training Site Status** "Atomic Force Microscopy of Biomolecules & Materials Relevant to Healthcare"

£253,703 **EPSRC Grant** (2002-2005) "Biomimetic Fibres for Tissue Engineering" (with KM Shakesheff, CD Melia, D Briggs and C Ives).

2003 £24,000 **BBSRC Case Studentship with GlaxoSmithkline** (2003-2006)

£20,000 **EPSRC Case Studentship with Avecia** (2003-2006)

2005 £299,658 **BBSRC Grant** (2005-2008) "Defining nanoscale high through-put screening of stem cell - biomaterial interactions"

BBSRC Strategic Studentship "Nanoscale analysis of polymer microarrays for biomaterial stem cell interaction"

£324,976 **EPSRC Grant** (2005-2008) "Pico-Newton MEMS Technology for Biological Force Measurement"

2006 £222,024 **Tibotec Pharmaceuticals Ltd** (2006-2008) "Characterisation of solid dispersions"

£558,000 **Nitto Denko Corporation** (2006-2010) "Development of a novel nanoparticulate systems for mucosal delivery (nasal and buccal)"

£186,268 **EPSRC** (2006-2010) "Colloidal Cell Delivery Systems" (with C Alexander, K Shakesheff)

RESEARCH PROFILE

STATEMENT ON RESEARCH

Over the last fifteen years, I have built a strong multidisciplinary research team employing surface biophysical tools for investigating biomolecular structure and interactions, and the interfacial chemistry of biomaterials. This work is important in not only determining the molecular basis of disease but makes a major contribution to the design and understanding the performance of advanced biomedical devices including

second generation biomaterials. Thirteen years ago, I established with a colleague, Professor Saul Tendler, the Laboratory of Biophysics and Surface Analysis which is sited within a purpose-built suite of laboratories in the JiF funded Institute of Pharmaceutical Sciences. The Laboratory has a mixed portfolio of current research funding of circa £2.4M derived from the research councils, EU, government and industry. As the Laboratory Director, I assist in the supervision of the research activity of over 20 postgraduate and postdoctoral fellows with expertise in the biological, physical and chemical sciences. The Group has developed into one of the most prominent surface science groups within the UK, has a growing international reputation in the field of surface biomedical analysis and has many close collaborative links with leading international scientists working in the biomedical and surface fields.

Research Achievements

I believe our group is at the forefront in the exploitation of scanning probe microscopy for the molecular resolution imaging of wide variety of clinically important biomolecules and biomolecular assemblies. We are one of the first groups to report on the applications of SPM to study biomolecular self-assembly including the association of ß-amyloid proteins in the formation of plaques observed in the pathology of Alzheimer's disease as part of a past collaboration with SmithKline Beecham.

Molecular resolution imaging has revealed the dynamic architecture of gene therapy polymer-drug constructs in collaboration with Professor Tom Kissel (Marburg). Sustained BBSRC funding has also allowed the group to employ the AFM to measure individual forces involved in biomolecular and polymeric interactions eg individual antibody-antigen complexes. Force mapping of biomolecular interactions is now a key activity of the group including recent EPSRC funding to study biomolecular membranes, and DTI for metrology studies. As part of a previous DTI LINK programme with Glaxo Group Research, novel molecular graphics software has been developed to allow the direct correlation of SPM data with information available from other biophysical techniques. EPSRC funding sited this as a national facility via the WWW.

I also believe our work has also made a major contribution to the molecular resolution imaging of biomolecules at surfaces which are either designed to promote highly selective recognition or those interfaces which have been constructed to minimise non-specific interactions. As part of a completed DTI/EPSRC Link programme with Kodak Ltd and Fisons Ltd, and a separate multi-centre EU programme, we exploited this expertise in the evaluation of both protein-resistant and biomimetic polymer surfaces which are currently of importance in biomedical and biocompatibility research. In collaboration with Johnson and Johnson Clinical Diagnostics within a BBSRC Link Scheme, we demonstrated the powerful role of the surface techniques in monitoring individual antigen-antibody interactions on microtitre and immunosensors. Parallel EPSRC/BBSRC funded studies probed the molecular topography of thin film coatings designed for biomolecular separation on chromatographic devices.

The imaging of drug crystals has emerged as a fruitful avenue of study where strong interactions with Professor Peter York are examining the role of supercritical fluid technology in crystal properties. Measuring surface interactions of pharmaceutically relevant materials such as inhalation particle-particle adhesion is being explored using AFM through GlaxoSmithKline funding. To achieve such goals, BBSRC funding allowed the construction of the first instrument capable of the simultaneous SPR and AFM analysis of such surface biointeractions. A separate EPSRC programme provided resources for the construction of an instrument for screening combinational libraries. Further EPSRC and BBSRC funding is leading to instrumentation developments in the use of near field scanning optical systems, microthermal analysis, a combined confocal SPR/AFM and a new cryogenic AFM system for biological studies.

Our work has received growing international recognition for the exploitation of surface analytical tools such as XPS and SIMS for defining the surface chemistry/topography of a range of advanced biomaterials, particularly biomedical polymers. This information can play a pivotal role in the design and optimization of novel biomedical devices. This approach is providing an insight into the relationship between surface chemistry of surface engineered colloids and their site-specific delivery *in-vivo*. Other activities have focused on relating interfacial chemistry/topography of novel urinary stents and catheters and heparin adsorbing filters for application in extracorporeal haemodialysis as part of European commission awards. The interfacial chemistry of surface engineered tissue engineering scaffolds is also a key theme of our research in collaboration with Professor Kevin Shakesheff. A new ToF-SIMS instrument sited within our group has been installed in a cross School initiative in the EPSRC Strategic Equipment Initiative. Very recently, a new XPS instrument has been funded through a multi-user EPSRC grant. The combined XPS and SIMS facility provides a unique platform for surface science studies and ensures Nottingham is at the forefront of international activities in the field. A strong collaborative links is now established with the National Physical Laboratory to continue to develop surface analysis tools for biomimetic systems. Our group was the first to use of AFM for the high resolution *in-situ* imaging within an aqueous environment of the surface degradation of, and subsequent protein release from, a range of biodegradable polymers and polymer blends. This work received outstanding referee reviews from the major international journals, J. Phys. Chem., Langmuir and Macromolecules.

The forward look

My future strategy is to develop the Laboratory of Biophysics and Surface Analysis as an outstanding international centre of excellence continuing to exploit recent advances in nanotechnological innovation to provide a greater understanding of the biomolecular structures of importance in disease and to assist in the development of raft of new generation of immunodiagostic and biomedical devices for therapeutic applications.

For example, notable achievements in the development of novel methods for the surface immobilisation of biomolecules including the use of self-assembled monolayers and protein assemblies will be used for the nanoengineering of biomolecular and polymeric micron-sized arrays on surfaces. Using such substrates, the SPM instrumentation will be employed as a molecular workbench, a rapid screening tool for ligand-receptor mapping and assay development and combinatorial chemistry analysis. In biomaterial development, international opinion and the UK foresight programme have highlighted the need for second generation biomaterials. The surface chemistry of many of these systems is vital to their *in-vivo* performance. We shall continue to exploit our surface biophysics expertise in probing the properties of such advanced materials as macromolecular complexes for gene therapy, "smart" stimuli-sensitive materials and polymers designed as scaffolds for tissue engineering.

All the above studies will be supported by on-going developments in novel instrumentation within the Laboratory. The construction of a new near-field optical scanning probe microscope for spectroscopic evaluation of biomedical surfaces is ongoing. As one of the first groups to develop algorithms for the derivation of structural information from, and to allow image interrogation of, SPM data, were previously awarded an EPSRC grant to act as the National Facility in this area. A new cryogenic AFM system is being constructed to attain high resolution biomolecular structure information and a new combined confocal/SPR/AFM system is being developed to measure thin film instrumentations.

In summary, I am striving to ensure our work makes an important contribution to defining the interfacial chemistry and structure of a range of biomedical and biological systems. Three young members of academic staff have joined the LBSA academic team

and forging strong independent careers, one of whom has recently received an EPSRC Advanced Research Fellowship and two promoted to Readerships. Our programs of research embrace basic and strategic studies aimed at both fundamental scientific knowledge and applied research in collaboration with industrial partners. It is hoped that these activities impact on many fields within biomedicine and underpin the objectives of recent government papers on science and technology, and technology foresight.

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A. REFEREED INVITED REVIEWS/BOOK CHAPTERS

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PUBLISHED ABSTRACTS

Well over **300 abstracts** (mostly peer-reviewed) have been published arising from international scientific meetings.

PATENTS

2002 PCT/GB00/03985 - BCP 111 "Zwitterionic Polymer Blend Materials"
Coinventors – Professor M.C. Davies, Dr. S. Clarke, Dr. A.L. Lewis

STATEMENT OF TEACHING

DEPARTMENTAL TEACHING DUTIES

I am currently teaching on modules relating to pharmaceutical formulations, pharmaceutical technology and controlled drug delivery.

All these courses have been satisfactorily reviewed by the Royal Pharmaceutical Society of Great Britain (2001) as part of their five-year accreditation scheme for the M.Pharm degree.

EXAMINATIONS

Postgraduate examinations

I have acted as **internal examiner** for many first year reports for postgraduate students, as internal examiner and **external examiner** (see C II) at a number of PhD examinations.

OTHER TEACHING

I have been an **External Examiner** at the Department of Pharmacy, Kings College, **University of London** (1993-97).

SPECIFIC POSTGRADUATE COURSE DEVELOPMENTS

(a) Departmental Postgraduate Tutor (1989-96)

As Postgraduate Tutor, I developed an extensive integrated postgraduate education and training course which is designed to equip graduates with key skills required both to undertake their selected research programme and in their future research career. Spread over the first semester of their first year of studies, a minimum of 70 hours general training was required to be taken by all postgraduates.

(b) Head of Life, Health & Agricultural Sciences Division, Graduate School (1995-97)

In this new role to the University, it was my responsibility to implement within the division (3 Faculties - medical, science and agriculture; 44 Depts; over 900 postgraduates) a strategy, which will achieve the overall aims and objectives of the Graduate School.

As a research-led institution, the University looked to me to increase the portfolio of taught postgraduate courses in this division. One key success was the initiation of a Divional wide Generic Training Programme for all new postgraduates to supply generic training programmes and modules which may be offered to students across departmental and faculty boundaries.

I am currently external examiner at the School of Pharmacy, Kings College London (2003-2007), School of Pharmacy, University of East Anglia (2003-2007) and School of Pharmacy, University of Bath (2004-2007).

Lectureships

Name	Current Position
Dr Clive Roberts	Professor, School of Pharmaceutical Sciences, UON
Dr Phil Williams	Reader, School of Pharmaceutical Sciences, UON
Dr Stephanie Allen	Reader, School of Pharmaceutical Sciences, UON
Dr Allan Coombes	Senior Lecturer, School of Pharmacy, University of Sydney
Dr Becky Green	Lecturer, School of Chemistry, Reading University
Dr Richard Frazier	Lecturer, School Food Biosciences, Reading University
Dr Marie Claire Parker	Lecturer, School of Chemistry, University of Glasgow
Dr Alex Shard	Lecturer, School of Chemistry, Sheffield University
Dr Sandy Chan	Senior Lecturer, Department of Materials Science, University of Southampton

Advanced Research Fellows:

Dr Phil Williams	EPSRC	University of Nottingham
Dr Kevin Shakesheff	EPSRC	University of Nottingham
Dr Neil Thompson	BBSRC	University of Leeds
Dr Marie-Claire Parker	BBSRC	Laboratoire de Géne Protéique et Cellulaire Cellulaire, France

Personal Chairs :

Professor Robert Short	Professor of Materials and Biomaterial Chemistry, Department of EngineeringMaterials, Sheffield
Professor Graham Leggett	Professor of Nanoscale Analytical Science, Department of Chemistry, Sheffield
Professor Kevin Shakesheff	Professor of Tissue Engineering and Advanced Drug Delivery, School of Pharmacy, University of Nottingham
Professor Clive Roberts	Professor of Pharmaceutical Nanotechnology

School Responsibilities

I was the Head of the School of Pharmacy and Pharmaceutical Sciences from 2000-2003. The Pharmacy School encompasses the skills of the Pharmacy School, Biomedical Sciences and also the research centres and institutes of Infections & Immunity, Cell Signalling, Drug Discovery, Cancer Chemotherapy and Pharmaceutical Sciences. Rated RAE 5* the School's research activities are organised into 12 research groups, which include 4 institutes, these are: biophysics & surface analysis; cell signalling; computational modification & informatics; cardiovascular sciences; drug discovery & tissue engineering; drug metabolism and separation science; health services and pharmacy-practice; infections & immunity; metabolism and nutritional sciences; neurosciences; public understanding of science.

The critical mass of the Pharmacy School is over 75 academics, 83 postdoctoral fellows, 10 experimental officers and 147 postgraduate students. It offers a powerful base for research collaborations. With current research grants in access of £25 million (BBSRC, EPSRC, MRC, JREI, JiF, AICR, EHF, CRC, NC, NIH, Royal Society, Wellcome Trust, DoH, EU, MoD, HEFCE, and the chemical biotechnological, and pharmaceutical industries) this research structure has also demonstrated a powerful network that can respond rapidly and flexibly to new challenges. The investment in infrastructure has seen a new Pharmaceutical Sciences build funded by a multinational JiF grant, of which I was co-author. One of only three science disciplines by BBSRC in the first round of applications. The Division of Medicinal Chemistry and Structural Biology is now housed within a new build, SRIF-funded Centre for Biomolecular Sciences Phase 1 of which was completed in 2005 and Phase 2, completed 2007, will house Tissue Engineering and Molecular and Cell Biology groups.

The school provides a broad base of skills which range from physical science to molecular microbiology to the whole animal and volunteer and patient studies, allowing an approach to pharmaceutical science and biomedical science research. The School has one of the highest holding of patents and licences in the University and is associated with 6 spinout companies. Pharmacy research unquestionably demands a multidisciplinary approach and the organisation of the Pharmacy School under the research umbrella introduces a sound research that that can identify, encourage and support the culture of interdisciplinary collaborations as evidenced by recent JiF award in nutritional genomics and EPSRC Metrology for Life Sciences Awards.

At an undergraduate level, there are 480 students starting a four year MPharm course rated excellent in the recent TQA assessment (23/24), with an annual intake of 135 (2001) some of the brightest students in the University and pharmacy sector (28.4 points). Over the last 5 years I have overseen a refurbishment programme to create one of the most advanced teaching environments worldwide, costing in access of £1.5 million. This investment in the teaching infrastructure demonstrates the School's commitment to the MPharm degree to keep pace with many changing developments and needs of healthcare professionals.